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ABSTRACT

A system employing a micro-level approach to the ongoing recording of educational equipment costs by educational program was developed. The system was designed to depreciate equipment and to allow determination of annual costs by educational program; consumption; maintenance and repair; interest on the capital investment; and insurance for purchased, donated, and rented equipment used by one program only and that used jointly between two or more programs. Guidelines for implementation are provided. The system provides for cost analysis procedures that allow cost comparisons and the determination of cost relationships and trends. Cost data provided by this system facilitate determination of the cost portion of cost-benefit studies concerning educational programs. The data provided by this system, over a period of years, can be used to develop standards that can be used as a yardstick to measure program, school, and district operations. Such cost data can provide guidelines when projecting costs of adding new programs and expanding present programs. The conceptual framework provides a basis for further development of instruments and procedures in the area of educational cost analysis. (Author)

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A METHOD FOR RECORD-KEEPING AND ANALYSIS OF EQUIPMENT AND RELATED COSTS BY EDUCATIONAL PROGRAM

Ruth G. Thomas

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July 19, 1975

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TABLE OF CONTENTS

Page

List of Figures iii

Chapter I - Description and Use of the Record-Keeping System . 1

Chapter II - Form I: Program Equipment Inventory, Depreciation and Cost Analysis 9

Chapter III - Form II: Jointly Used Equipment Inventory, Depreciation, and Cost Analysis Form . 29

Chapter IV - Form III: Rental Equipment Cost Analysis Form . 35

Chapter V - Form IV: Yearly Summary 40

LIST OF FIGURES

Figure		Page
1.	Form I - Program Equipment Inventory, Depreciation and Cost Analysis Form	11
2.	Form I - Yearly Update	27
3.	Form II - Jointly Used Equipment Inventory, Depreciation and Cost Analysis Form	30
4.	Form II - Yearly Update	34
5.	Form III - Rental Equipment Cost Analysis Form . . .	36
6.	Form III - Yearly Update	39
7.	Form IV - Equipment Cost Analysis Yearly Summary . .	41

Chapter I

DESCRIPTION AND USE OF THE RECORD-KEEPING SYSTEM

The job of administering educational programs grows ever more complex as technological changes occur, as costs for educational services rise, and as public demands for educational services increase in the face of limited resources. Educational administrators, although they have control over many factors such as resource allocation, program alternatives, and methods of implementing and maintaining programs, have little or no control over other factors which greatly influence the educational institution such as community demography, levy limits, and property valuation. This situation necessitates sound decision-making relative to those factors which are under the administrator's control.

Educational accounting systems for public schools, like all accounting systems, have been designed to produce needed information. That information in the past has been centered around legal requirements and around state and federal reporting requirements. Needs change over time, however, and so must accounting systems if they are to produce information consistent with those evolving needs.

Today educational accounting systems must produce information for decision-making as well as for reporting and for accountability. The decision information needs relate specifically to resource allocation, budget planning and choosing between alternatives. Accountability information needs encompass justifying expenditures to the public in view of limited resources and ever increasing demands for educational services which are becoming increasingly costly.

Cost analysis of educational programs is advocated by those concerned with educational decision-making and accountability. Present educational accounting systems, however, do not yield information needed for such analysis. Methods

of costing educational programs have been developed and have been implemented by educational institutions but many methods are impractical for school districts, especially smaller districts, in terms of time, personnel and funds requirements.

The purposes of the system presented here are to provide a means by which educational equipment costs might be assigned to educational programs, and to provide for the collection and recording of instructional equipment cost data by program. Educational equipment is defined as the equipment used for instruction in a particular program or in more than one program, including audio-visual equipment.

This system provides a micro-level approach to cost allocation. The forms presented in the following pages provide for the on-going recording of equipment cost data as equipment is acquired and as changes in equipment status and use occur, as opposed to a "one-shot" cost analysis procedure which attempts to determine program costs at only one particular point in time. By providing continual cost data, the system allows comparisons from one year to the next and allows the determination of relationships and trends which are only possible with longtitudinal data.

Costs related to programs are charged to those programs. Since costs are also assignable to individual schools, it is possible to analyze all the cost variables included in the system by school as well as by program.

Gradual system development is allowed. Various portions of the system may be implemented without necessitating the implementation of all portions of the system. This flexibility allows an individual school some option in choosing the amount and kind of information that is desired and that can be collected within time, funding and staff constraints. Methodology for course

level breakdown is illustrated and described. Thus, the system provides for program level breakdown as a starting point but also indicates how the progression to a finer course-level breakdown can be accomplished.

The system provides for PPB systems by using a program-based approach and by providing information useful for deciding between alternatives.

The record-keeping system will yield detailed information. The accuracy of that information is dependent upon the ability of faculty and administrators to assign realistic equipment use time, expected life and salvage values. Hours used is the basis on which equipment costs are allocated to educational programs. Time spent is the basis on which maintenance and repair personnel costs are allocated. Quantity consumed is the basis on which power costs and maintenance and repair supplies costs are allocated. Straight line depreciation based on historical cost (purchase price plus installation, freight, and any other costs required to ready the equipment item for its intended use) is used to spread equipment acquisition costs over the useful life of the item.

Two crucial components of the system are the classification of programs and the categorization of costs. These determine what can be done with the data accumulated by the system because they delineate the degree of detail provided and the information groupings possible.

Classification by program allows costs to be classified according to product and service. Costs are also classified by the year in which they are incurred. Cost data are analyzable according to the tendency of costs to vary with volume or activity. Depreciation costs are basically non-variable costs except as volume or activity are considered in the estimates of expected life and salvage value. Power consumption costs and maintenance and repair costs are analyzable as costs which do vary with volume or activity.

The system provides for analysis of direct and indirect costs, variable and fixed costs, joint and specific costs, and recurring and non-recurring costs. Each cost category is discreet and can be analyzed.

The system provides for the equipment-related cost portion of total program costs, per student and other unit program costs, differential program costs, excess costs, and marginal costs.

The system provides for both the association of capital costs with operating costs and for the separation of those costs.

Information useful for cost-benefit analysis such as annual portion of capital costs, interest on the capital investment, and program portions of some utilities and maintenance and repair costs is extractable. The system prevents cost distortion by eliminating the need to assign equipment purchase expenditures to programs as current costs in the year of purchase and by excluding equipment purchase costs from assignment to educational programs.

Information of value to administrators is yielded by the system. Administrators are provided with a means of checking the accuracy of their planning because a quantitative measure of at least some aspects of program cost is available. Administrators are also provided with information useful for estimating future relationships and predicting future costs.

The system yields information about the costs of equipping a laboratory for a particular program. Such knowledge helps the administrator to decide whether or not it is feasible for a school district to initiate a particular new program, to consider the equipment costs of several possible new programs, and to determine whether or not present levels of program operation are efficient.

Information made available to the administrator by the system allows objective assessment of department heads' budget requests. A factual basis

is provided for making resource allocations. The department head is also provided with documentation for departmental budget requests.

The system provides the administrator with information as to probable equipment replacement requirements, level of equipment use in the educational programs under the administrator's jurisdiction, equipment maintenance and repair data, and a portion of the school's instructional power consumption costs. Knowing the intensity of equipment use assists department heads and administrators when planning class schedules, assigning room locations for courses, and when making decisions concerning the acquisition of additional equipment.

Information provided concerning equipment maintenance and repair costs can indicate to a department head and an administrator the kind of care educational equipment is receiving, and the type of service program that is least costly in terms of frequency and cost of repair. Having specific figures available can assist in communicating equipment use and care guidelines to faculty members. Information regarding maintenance and repair of equipment, power usage, and number of dollars invested in a program's equipment is useful for those who determine school policies. An example of policy-making use of cost data would be the development of policy related to the availability of educational facilities: to whom, to what extent, during which non-school hours, and, if charges are to be made for their use, the determination of appropriate rates.

Operation, maintenance and repair costs are more easily determined in conjunction with, rather than separate from, the listing of equipment items. Thus, collection of such data is more easily accomplished within the inventory system than within the accounting system. Once the data are summarized, they can be entered in the accounting system for cost accounting and other purposes.

Unit costs obtainable using the data yielded by the system allow comparisons of educational programs within a school, between schools and between districts. After the system has been in operation for several years, standards can be developed which provide a yardstick against which program, school, and district operations can be measured.

When cost data such as that provided by this system are used in evaluation of programs and justifying expenditures, they must be coupled with information regarding program objectives and program output. Cost data by itself can be grossly misleading.

Responsibilities for implementing, maintaining, and operating the system rest with administrative staff, faculty, and clerical personnel. Specific responsibilities are outlined for each type of staff. If the assumption that when people are involved in the development and operation of a project they are more likely to use the results of that project than if information is "handed down" is correct, then the distribution of responsibility among administrative and instructional staff should help to insure use of the cost data by those staff members. The involvement of clerical staff in the operation of the system should result in less resentment on the part of faculty toward the system because the tasks required of the faculty will be less time consuming and burdensome. This factor should also encourage use of the cost data by instructional staff.

The information provided by the system is consistent with that required for state and federal reports. The information is also in a form compatible with information requirements for school budgets, as function-object identification is maintained.

The record-keeping and analysis methods developed for the system are suitable for use in either a manual or computerized system. Whether or not a computer is available, the system should be carried out by hand until it is

reasonably certain that major changes will not be required. The system is adaptable to both large and small school districts. No highly sophisticated mathematical computations or statistical techniques are required.

It is not proposed that the system presented here is in final form. This system is but a step in the direction of program-based cost analysis. Some of the benefits and needed refinements will not reveal themselves until the system has been in operation for a time. Periodic evaluation and revision are necessary to keep the system up to date and representative of situations as they change.

Administrative staff, department heads, faculty and clerical staff should be involved in the early discussions leading to the development of the cost-analysis system. It is important that all understand why the system is being implemented and how its results will be used. In this way faculty are less likely to feel threatened by the system. Because cooperation of instructional staff is essential to the accuracy of the information delivered by the system their support is a necessity.

One factor which will help to insure faculty support is the appropriate use of the data, e.g. the cost figures of a program which has undergone cost analysis should not be compared with those from a program which has not undergone similar analysis. Program comparisons must be made on other bases beside costs. Attainment of objectives and consistency of program objectives with those of the school, program output and consistency of that output with student and manpower needs are other factors that must be considered. Cost units used, and costs to be included must be given careful attention when comparing costs between educational programs.

Program cost data should be used to make comparisons between schools, educational levels and states to determine the causal factors which produce cost differences, and also to determine what changes might be made to improve cost/productivity ratios. Program cost data should be used by administrators and department heads to cooperatively plan present and future budgetary needs, evaluate programs and make changes that are beneficial to educational programs in the most rational and economical ways possible. Program cost data should be used by state departments of education in making funding and program development decisions on a rational basis. Such departments could compile and summarize data by size of school district and disseminate that information for use by schools as standards of comparison.

Whatever information is developed, it is important that it be used. Nothing is more discouraging for personnel than to have expended a great deal of effort in data collection only to have it filed away and unused. This factor enforces the premise that the data must be useful.

The person in charge of recording new equipment acquisition information in the system and inventorying equipment each year should have a contract providing for employment before the start of the school year and after the school year ends. Thus, new equipment can be catalogued and ready for use when school starts in the fall, and a final check on inventories and orders for the following year can be made in the spring. The length of time required in the spring and fall for these duties will depend on the size of the school district.

Chapter II

FORM I: PROGRAM EQUIPMENT INVENTORY, DEPRECIATION, AND COST ANALYSIS

To be able to identify costs by program area, it is first necessary to delineate program structure. The determination of program areas makes possible a "chart of accounts" by which cost data can be recorded.

Defining programs in terms of curricular areas (e.g. Industrial Education, Math, Agriculture, English, Home Economics) is the recommended approach. However, programs can also be defined in terms of grade level or various combinations of grade level and curricular program.

Because educational outputs are measured in terms of educational programs, if program inputs (i.e. resources) are to be related to program outputs (e.g. numbers of students graduated, credit hours, clock hours or contact hours generated) inputs must be measured on a program basis also. The measure of output used will determine the nature and scope of the program structure by which program costs must be recorded. For example, if outputs are measured in terms of the vocational education program as a whole, then the costs of all the vocational subject matter areas could be recorded under a vocational education "program". The disadvantage of such a broad definition of program area, however, is that less information will be produced than would be the case if programs were defined on a less aggregate basis. The recommended approach of defining programs in terms of curricular areas produces cost information which can be related to an identifiable, quantifiable output, and has the advantage of making comparisons between subject matter areas possible.

Programs might also be defined at the subject matter sub-division level. An example of program structure at this level would be to define Agribusiness,

Production Agriculture and Agricultural Mechanics as programs for which costs will be recorded. Defining programs at this level will produce more information than will defining programs at the broader subject-matter area level, in this case, Agriculture. Defining programs at the sub-division level will also require more time and effort spent in recording costs.

Decisions must also be made concerning what items are to be defined as equipment. Items categorized as equipment will be inventoried, depreciated, and recorded in the record-keeping system. Several approaches to such categorization are possible. Items costing more than the minimum value for equipment reimbursable by state departments of education might be considered equipment; the guidelines provided by state school accounting manuals for distinguishing between supplies and equipment might be used; districts with inventories organized by equipment values might find it most convenient to choose a cut-off point consistent with their inventory organization. The lower the dollar value chosen as a cut-off point for defining equipment, the greater will be the number of items categorized as equipment. Although more information will be yielded by the record-keeping system when a larger number of equipment items are included, more time and effort will be required to obtain that information.

Form I, presented in Figure 1, provides for depreciation of educational equipment and for cost analysis of equipment by program. This form also provides an equipment inventory.

Information illustrated at the top of the form identifies the form number and name, the group of programs, the school district, the year, the program name and code, and insurance and interest totals. Although the information items included here may vary somewhat depending on program structure, size of school, desired information, and other factors, it is essential that the program and

Fig. 1--FORM I

School District_____

Year_____

Int._____, Ins._____

PROGRAM EQUIPMENT INVENTORY, DEPRECIATION AND COST ANALYSIS FORM

(Items Costing _____or more)

Secondary Vocational Programs

Program Code_____

Program Name_____

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Inventory Number	Item Name and Description	Bldg.	Rm.	Acq. Date	Obs. Date	Total Cost	Sal. Value	Exp. Life	Yearly Deprec.	Current Value	Courses Used in	No. Hrs. Used/Yr.	Prop. of Tot. Hrs.	Course Cost for Dep.	Watts, Volts & Amps., H.P.	No. KW Hrs. Used/Yr.	Rate /KW Hr.	Elec. Cost /Yr.	Maint. & Repair Cost/Yr.
Totals:																			

the year be identified on the form. The name of the person with immediate responsibility for the equipment (such as the department head) might also be included at the top of the form.

Depending on the degree of decentralization with respect to responsibilities for equipment inventories and maintenance and repair, it may be more appropriate to specify the building at the top of the form rather than in Column C. If equipment inventories are maintained at the district level, leaving building identification in Column C would be more practical. If equipment inventories are maintained at the building level, then the building identification might be placed at the top of the form.

Form I has been designed so that sections might be included or excluded, depending upon the amount of information desired. The heavy lines separate groups of columns which deal with related elements of information.

Columns A-K include the minimal kinds of information schools presently keep concerning their equipment, plus information needed to depreciate equipment and record that cost on a yearly basis.

Columns L-O provide for yearly equipment depreciation costs on a course by a course basis. This section allows the determination of equipment depreciation cost by sub-program (e.g. Agri-business, Agricultural Mechanics, Production Agriculture). Columns A-J provide for the determination of equipment depreciation cost for the total program category only. For example, one could determine depreciation costs for the equipment for the total agriculture program using columns A-J. If columns L-O are added the equipment depreciation costs for production agriculture, agriculture mechanics and agribusiness could also be determined.

Columns P-S provide for the determination of electrical power consumption costs incurred by equipment for an entire program category. Sub-program power costs can be obtained by using the information concerning use of equipment in

specific courses from columns L-N and entering course costs as sub-entries in Column S. Power consumption costs of equipment using power sources other than electricity could be accounted for under a heading of non-electrical power. Because electricity consumption is based on information specifically given on the equipment, it seems more convenient to deal with power consumption costs when dealing with other equipment costs. Deletions and additions of equipment are easier to deal with only once - on the inventory form, rather than having to make entries and deletions on several forms.

The fourth section, Column T, provides for equipment maintenance and repair costs by total program as well as by course with the use of sub-entries. A specific discussion of each column heading follows. This overview is provided to show the flexibility contained in the system in that the columns in group 1 (A-K) can be used with or without column groups 2, 3, and 4. If course costs are not desired for any of the equipment cost elements (depreciation, operating power, repair and maintenance) columns pertaining to these costs (L, N, and O) would be deleted and Columns M, Q, S, and T would have no sub-entires.

Audio visual equipment might be included on this form if it was purchased for use by one program category only. That purchased for use by two or more programs should be entered on the joint equipment form discussed in Chapter III.

The information under each heading in Form I is to be entered for each equipment item. It may be possible, however, to aggregate a group of similar items and treat them as one item when completing the form provided they all have the same expected life and are used in the same courses for the same number of hours.

Column A, Inventory Number, can incorporate the program code number plus additional digits that identify the specific item. Items can be numbered

in numerical sequence as they are listed on the form. An alternative to a numerical sequence inventory numbering system would be to group all similar items together such as illustrated below:

Column A

Inventory Number

Ranges

3070001
3070002
3070003

Refrigerators

3070020
3070021
3070022

Freezers

3070030
3070031

Other group listings are possible such as by room, by course, or by instructor. These are subject to change, however, whereas the like items grouping would not change (once a freezer, always a freezer). The numerical sequence numbering would result in a grouping of items by age since the items would be entered as they were acquired. A grouping by life expectancy would allow prediction as to what items are likely to need replacing in the near future. Groupings are more important for hand systems than for computer systems, since computer systems can group items by any variable on which information is provided. The size of the school district and of the department would be influential in selecting a convenient grouping. The serial number of the item should be included for security purposes. It could be entered as a second line inventory number, as part of the item description, or a separate column could be provided.

Column B should contain enough description to make the item identifiable. Item identification would be best achieved by attaching the inventory number to the item, particularly if the item has no serial number. An example of an entry in column B might be: Magic Chef Deluxe free-standing gas 30-inch range, gold, one oven.

Column C indicates the building in which the equipment is used. It is assumed that most instructional equipment will not be used jointly between buildings. As pointed out previously, this information might be more appropriately included at the top of the form.

Column D indicates the room where the equipment item is either used or housed, whichever is more appropriate. This information is useful for security purposes, for assigning equipment costs to courses and for planning equipment purchases for new classrooms and laboratories.

Column E indicates acquisition date whether acquisition be by purchase, donation, etc. The date chosen might be the month and year purchase funds are accrued or the date the item is entered on Form I of the inventory. The latter is preferrable because all entries required on Form I when an item is acquired could be done at one time. Ideally, all available required information should be entered on Form I before the equipment item is put into use, before it is taken out of the office where that information is recorded.

Column F indicates year of expected obsolescense. Although this could be calculated quickly from the information given in columns E and I, expected obsolescence date is an information item which requires entry only once and which provides an "at a glance" indication of the number of items expected to need replacement in a given year. This information is helpful in budget planning.

Column G is for entry of the total installed price of a purchased item including freight and other costs necessary to make the item operable in its intended location. A donated item involving no cartage or installation costs could have a zero in this column. In that case Column J would also have a zero value for this item. However, columns H, I, and K could have values other than zero for the item. Since the equipment could be sold or traded in, it would have a salvage value. The item can be expected to last a certain length of time. Thus, it could be assigned a current value which would have to be adjusted yearly according to a depreciated value schedule. This yearly depreciation would be an indication of rate of change in value rather than an indication of yearly cost. Because column J is used to determine yearly equipment acquisition costs, it would be inappropriate to enter in this column a figure which does not represent a cost. The item does have to be included in the inventory, however, and its operating, repair and maintenance costs do need to be assigned to the program. If freight and installation costs are incurred these would likely not be sizeable enough to spread over the expected life of the item and the total could be included as costs to the program in the year of acquisition.

Column H, salvage value, is to include the estimated trade-in or sale value of the item at the end of its expected life. This estimate could be made by either the department head, the individual teacher most familiar with the equipment, or an administrator experienced in education equipment trades, sales, and markets.

Column I, expected life, should be filled in by department personnel. This figure represents an estimate of how many years the equipment item is expected to yield service to the educational program. Obsolescence as well as wear and tear must be considered in that estimate.

Column J represents the annual depreciation cost of each equipment item. This figure represents the portion of the purchase price which should be

charged to a program each year. Figures for column J are obtained by using straight-line depreciation. The procedure for calculating figures for column J (with the exception of donated items) is:

$$\frac{\text{Column G (total acquisition cost)} - \text{Column H (salvage value)}}{\text{Column I (expected life)}} = \text{Column J (annual depreciation)}$$

Current value figures (Column K) are obtained by subtracting the figure in Column J (annual depreciation) from the figure in Column K for the previous year. For donated equipment, a figure based on age and condition of the equipment should be entered in column K.

Column L allows the association of equipment costs among "sub-programs" (such as production agriculture, agriculture mechanics and agribusiness within the agriculture program) by providing for the association of cost variables with courses. If a further breakdown to course sections is desired, the words, "course sections" would be substituted for the word, "course".

If course or course section breakdown is not desired, Columns L, N and O may be omitted, resulting in cost figures for only the total program. Subentries would then also be eliminated from the form in Columns M, Q, S, and T.

Column M is needed to calculate power consumption costs for the determination of program costs. In most cases, completion of Column M will require consideration of specific courses. With minimal additional effort the course costs and thus sub-program costs for equipment can be obtained. Course costs for depreciation can be obtained by determining the proportion of the total hours the equipment is used in each course (Column N) and multiplying this percentage by the figure in Column J. Course costs for maintenance and repair can be obtained in the same manner. These calculations are explained below.

Column M indicates the number of hours each equipment item is used per year. This figure may be easily obtained for equipment used on a regular basis. For items used irregularly, an estimate by instructors will be necessary. Although the number of hours an item is used does not indicate either the number of students using it or the intensity of use, it is assumed that hours used adequately measures equipment usage.

The sub-entries in Column N indicate the proportion (expressed as a percent) of the total time an equipment item is used in each course. Entries for column N are calculated by: 1) adding the sub-entries for each equipment item in column M to obtain a total number of hours an item is used; 2) dividing this total into the number of hours from Column M that the item is used in each course; and 3) multiplying by 100 to obtain the percent for each course which is then entered in Column N.

Entries for each course in Column O are calculated by taking the percent in Column N for each course and multiplying times the yearly depreciation figure for the equipment item given in Column J (O=NxJ).

Columns P-S are concerned with determining the yearly electrical power consumption costs of equipment. Non-electrical equipment would require alteration of the headings in this form to accomodate the necessary measures of operation costs. These columns would not apply to furniture or any non-electrical equipment. It is assumed that most equipment items which use a power source are electrical and therefore the sample form is set up to accomodate electrical equipment.

The wattage rating on a piece of equipment should be entered in Column P. If volts and amps are given instead of watts, these should be entered. In cases where horsepower rating is the only electrical power rating given, that should be entered. To calculate kilowatt hour entries for each equipment item

in Column Q, the appropriate formulas from among the following should be used:

1. When watts are given:

$$\text{Kilowatt hours} = \frac{\text{Watts} \times \text{Hours}}{1{,}000} = \frac{\text{Column P in watts} \times \text{Total hours an equipment item is used from Column M}}{1{,}000}$$

2. When volts and amps are given this must be converted to watts by the following formula; then the above formula may be used to determine kilowatt hours:

Volts X Amps = Watts

3. When horsepower is given it must be converted to watts by one of the following formulas; then the above formula may be used to determine kilowatt hours:

a. Formula for use with motors having less than ½ horsepower rating:

(H.P. = Horsepower)

H.P. X 1200* = Watts

b. Formula for use with motors having ½ or greater horsepower rating:

(H.P. = Horsepower)

H.P. X 1,000* = Watts

The rate/KW hour entered in Column R will vary from one locality to another and will usually vary with the total amount of electricity consumed by a school district since most utility companies' rates are based on a sliding scale. Whatever rate is used, it would be the same for all equipment items but subject to change when rate changes from utility companies occur.

Figures for Column S are obtained by multiplying the kilowatt hours in Column W times the rate in Column R. This calculation yields the yearly electrical

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*a power factor of 1200 is used to compensate for power loss in a small motor; a power factor of 1000 is used with larger motors.

operating cost for the equipment item. To determine course costs, the yearly electricity cost in Column S is multiplied by the percent found in Column N for each course. An alternate method of determining course costs for electricity is to enter in Column Q the number of kilowatt hours of electricity consumed by each course. This would be calculated by multiplying the equipment item's wattage rating (either calculated from information given in Column P or obtained directly from Column P) times the number of hours the equipment item is used in each course found in Column M. The kilowatt hours consumed by the item in each course would be entered in sub-entries in Column Q. Then the rate from Column R would be multiplied times the entry in Column Q for each course and the resulting cost figure would be entered in Column S as a sub-entry for each course.

Both methods yield approximately the same results and require the same number of calculations of equivalent complexity. The primary difference between the two methods is that the former does not require sub-entries in Column Q while the latter method does require sub-entries. Consequently, the latter method provides an additional item of information - number of kilowatt hours of electricity consumed by each course. The importance of this information is negligible, however, because kilowatt hours are based on hours used which is already given in Column M. If the former method is used to calculate electricity consumption costs, the sub-entry lines in Column Q should be deleted.

Column T includes service contract costs, repair costs and maintenance costs such as cleaning, lubricating, etc. If these duties are carried out by instructors and students in class it is recommended that only the cost of the materials be recorded here as the instructor's salary would already be charged to the program. These materials costs might be more easily recorded on a supplies form but the advantage of recording them here is that they would be appropriately

labeled as an equipment-related cost. This separation could also be done on a supplies form. Which form is more convenient to use for the recording of these kinds of supplies will depend upon the procedures by which the supplies are obtained and distributed, who uses them and who has the responsibility for recording the costs on the form.

Service contracts which cover many equipment items for a program can be handled in various ways. For example, cost of a service contract for typewriters in a business program could be split equally among the typewriters. The resulting cost for each typewriter would then be multiplied by percents in Column N to determine course costs for Column T. Service contracts which cover equipment for more than one program category can be allocated to program categories on the basis of the actual service time the equipment in each program required. When parts or special supplies are purchased in specific repair instances, their cost can be entered by equipment item.

Totals for Columns J, S and T added together yield the total annual equipment costs for a program category for depreciation, power and maintenance and repair.

Interest on the capital investment, while not representing dollars expended, does represent an opportunity cost and is information needed for cost benefit studies. The line at the top left side of the form labeled "Int." provides for a figure representing the interest on the money invested in equipment for the program category. This could be determined for the course level but would require an item by item calculation. The value of such a procedure seems dubious; it is recommended, therefore, that this calculation be carried out for each total program only.

To calculate annual interest on the capital investment Column G must be totaled. This total is then divided by 2 to obtain an average figure which is

multiplied by an interest rate. The most appropriate rate is a controversial issue but the most generally accepted rate is that rate of interest paid on school bonds. Use of this rate is logical because if the funds were not tied up in instructional equipment they could be used to reduce the school's debt and therefore reduce the school's interest payment.

Insurance costs for equipment usually are based on a rate for the original value of the equipment. The line labeled"Ins." at the top left side of the form just to the right of the interest line provides for recording insurance costs. The total for Column G times the rate for insurance yields the appropriate figure for this entry.

Totals should be determined for Columns G, J, K, Q, S, and T. The total for Column G indicates the total amount of dollars invested in equipment for the program category, excluding equipment purchased for joint use between two or more programs, and rental equipment. This total represents a direct cost to the program. The figures in this column would aid in determining marginal costs if such costs would involve equipping a new classroom or laboratory. This total would also be helpful in deciding between alternative programs by providing an indication of investment costs.

The total for Column J represents the annual cost of equipment purchased for use in the total program category. This figure is the "year's share" of the total cost of the equipment. This total would be helpful in determining differential program costs and total annual program costs. This item represents the annual portion of the same kind of direct cost as the total for Column G, minus salvage values.

The total for Column K indicates the total current depreciated value of the equipment purchased and donated for the program. This figure is useful for insurance purposes and for determining trade-in values.

The total figure for Column Q represents the total number of KW hours used by equipment each year in a program category. This figure could be useful when comparing costs of programs within or between schools and districts, determining equipment usage levels, determining room schedules, and planning budgets. The total for Column S would have almost the same uses as Column Q, but would not aid in room scheduling.

The total for Column T would also be useful for comparing programs. Comparison of Column T totals for similar programs, with additional information as to enrollments and the number of hours scheduled classes use equipment, could be indicative of the kind of care equipment receives and/or what kind of service program is ultimately least costly. Both Column S and Column T totals would be useful in determining total program costs, in budgeting, and in making decisions concerning resource allocations.

Per student costs can be determined for programs and/or courses by dividing by appropriate enrollment figures. Cost per student hour may be determined by multiplying enrollment by the number of hours equipment is used before dividing. Cost per student per class hour could be obtained by multiplying enrollment by the number of hours the course meets in a year before dividing.

The question of which items already owned are to be included and which items are to be excluded from the information system will inevitably arise. One possible solution would be that information required on the form in Figure 1 be gathered only on equipment acquired after the system is implemented.

Two advantages of this approach are that a very gradual changeover would be possible and when changes in the system are necessitated they would be easier to make. This gradual approach necessitates the maintenance of both the present inventory system and the new system until the changeover is complete. If the long time period required for changeover is undesirable, the

equipment in a program can be placed on the new system more quickly by establishing a cut-off date. For instance, equipment acquired within the past 5 years could be included in the new system. Going back more than five years usually invites problems because records may be incomplete or non-existent.

Information can be recorded on either a card or list format. Cards would be used in a computerized system. Cards also have an advantage in a hand system because they can be sorted according to given variables. With all information in Form I accumulated on each equipment item appearing on a card, and one card for each equipment item, the cards could be sorted for analysis by program, by building, room, obsolescence date or any variable included on the form. The cards could also be filed by any variable.

Although the availability of a computer would greatly simplify the tasks involved in such record-keeping, the system can be carried out by hand. It is recommended that it be done by hand even if a computer is available until it is fully implemented and adapted to a school system to avoid expense in re-programming when adjustments must be made.

As indicated earlier, responsibility for completing the form depends somewhat on administrative structure. Clerical help can fill out a portion of the form. Department heads and instructors must fill out parts of it. Recommendations are:

Column A, B, C, D, E, G, P - should be completed by the administrator responsible for the program. All of these columns require recording once, at the time of acquisition, for the life of the equipment item unless the item is moved to a different location within the district. In that case building and/or room would need to be changed.

Columns F, H, I, L, M, T - should be completed by department heads and instructors. Three of these columns (F, H, and I) would require only one entry at the time of acquisition. Columns L and M would require yearly examination and, if necessary, adjustments. Column T would require yearly entries if a separate log of maintenance and repair costs is kept. Otherwise, entries must be made in Column T when expenditures for maintenance and repair occur.

Columns J, K, N, O, Q, R, S - can be completed by clerical personnel. Of these, only J requires a one-time entry at time of acquisition. All of the others would require yearly checks and adjustments.

The advantages of a system which enables much of the yearly, on-going activity to be carried out by clerical staff are several: there will likely be less resistance among instructional staff as long as a minimum of their time is consumed by record-keeping; the system is less expensive; the amount of work required would justify one full-time clerical staff who would become very knowledgeable concerning the system.

If the task can be divided it is not so overwhelming for any one person or group and is less likely to be resented. The completed forms should be readily available to department heads who should be as involved in the use of the information as they are in the recording of it.

The form for yearly updating of Form I is shown in Figure 2. The format of this yearly update form provides two sections which can be superimposed over the Form I master sheet. Columns K through O are included in one section and Columns W through T are included in the second section. By superimposing these forms containing only those columns requiring yearly examination and for some columns, yearly entries, information available on the master form needed for calculations on the yearly update form does not have to be re-copied.

The information at the top of the update form identifies the year of the update and the program.

Column K on the yearly update form would require subtracting the annual depreciation for the equipment item from the figure in Column K the previous year. The result is the current value to be entered in Column K.

Column L will not need adjustment if no change in the course usage of the equipment item has occurred. If changes have occurred they must be indicated in Column L.

Column M and N will not require adjustments if courses and/or course sections have not been added or subtracted and the equipment is used in the same manner in the same courses. If changes have occurred, this must be indicated in Columns M and N. When Column L requires adjustments, adjustments will usually be required in Columns M and N.

If changes have occurred in Columns L, M and N, adjustments will be required in Column O.

Column Q will require adjustments if adjustments were required in Columns M and N. Column R will require adjustment only if rate changes from the utility company have occurred. Figures in Column S need to be adjusted if change has occurred in either Column Q or Column R.

It would be anticipated that Column T would almost always vary from year to year and thus would require yearly entries.

New equipment must be recorded on Form I. Interest on the capital investment and insurance costs must be determined for new equipment additions and added to that for previously recorded equipment. If a change in interest rate or insurance rate occurs, previously determined insurance costs and interest on the capital investment must be adjusted.

The primary purpose for Form I is its function in spreading the initial cost of an equipment item over its expected years of service. The availability

Fig. 2--FORM 1 Yearly Update

School District _____

Year_____

PROGRAM EQUIPMENT INVENTORY, DEPRECIATION AND COST ANALYSIS FORM
(Items Costing _____or more)

Secondary Vocational Programs

Program Code_____

Program Name_____

Int._____, Ins._____

K	L	M	N	O	Q	R	S	T
Current Value	Courses Used in	No. Hrs. Used/Yr.	Prop. of Tot. Hrs.	Course Cost for Dep.	No. KW Hrs. Used/Yr.	Rate /KW Hr.	Elec. Cost /Yr.	Maint. & Repair Cost/Yr.

of yearly cost information concerning equipment purchase prices eliminates the problems of determining annual program costs using current operating cost figures. Thus, annual program costs can be calculated at any stage of the program without incurring cost distortions due to large equipment expenditures in initial stages of new programs.

Form I also yields cost information on a program basis which eliminates the necessity of sifting through school district documents, a task which cost analysis researchers have found themselves forced to do.

Including equipment power consumption costs and costs for equipment maintenance and repair in Form I yields information about these cost areas on a program basis. Thus, part of the need for prorating these costs from district-wide figures is eliminated.

Chapter III

FORM II: JOINTLY USED EQUIPMENT INVENTORY, DEPRECIATION AND COST ANALYSIS FORM

Equipment purchased for joint use between programs is included in Form II, presented in Figure 3. Such equipment could be used jointly by two or more vocational programs or by vocational and other programs. Audio visual equipment is likely to be included here. Form II allows assignment of costs to programs in much the same way that Form I provided for assignment of costs to courses.

Columns A and B would be filled in as for Form I. Column C indicates the building where the equipment is housed or stored. Column D indicates the room where the equipment is housed or stored rather than the rooms where it is used since it is likely to be used in several rooms. Columns E through K are filled in as for Form I. Columns L through O are not optional in this form as they were in Form I. They must be included if program costs are to be determined. The procedure is similar to that for determining course costs in Form I.

Column L indicates the code numbers of the programs for which the equipment is available. Column M indicates the number of hours each program uses the equipment per year. Column N indicates the percent of the total hours the equipment item is used in each program. The percentages in Column N are calculated in the same way as those for Column N in Form I were calculated where the sub-entries in Column M for a particular equipment item are added together to determine the denominator. The numerator is the number of hours

indicated by the sub-entry for a program in Column M. Dividing the denominator (total hours used) into the numerator (hours used in the program) and multiplying the result by 100 yields the percent of total hours an item is used in that program.

Column O indicates each program's share of the annual portion of the purchase price. This is calculated by multiplying the percent in Column N for each program times the yearly depreciation figure in Column J.

Columns P through T are completed in the same way as those columns on Form I. These columns on Form II yield costs for each program whereas these columns on Form I yield costs for each course. To obtain costs for each course for jointly used equipment would require further breakdown of per program costs and would require an additional form to record the cost information for each program found on Form II.

Column V provides for recording insurance costs of joint equipment by program. Figures for this column and those for Column W are distributed to programs in the same basic manner. All costs in Column G on Form II are totaled. This figure is multiplied by the insurance rate (often expressed as so many dollars/$100 of original equipment value) to yield the total annual insurance cost for all equipment on the form. If the insurance rate is expressed as other than an annual rate, an annual rate must be determined before the insurance rate is multiplied by the total for Column G. The entire Column O is then totaled to yield the annual cost of all equipment listed on the form. Each program's entries in Column O are then added and divided by the total for Column O. The result is multiplied by 100 to yield a percent of the annual equipment cost for each program. This percent is entered, along with the program code in Column U. The percent of annual joint equipment cost for each program entered in Column U is multiplied by the total

insurance cost for all the equipment on the form to yield the insurance cost attributable to each program which is then entered in Column V. The formulas below illustrate the procedure:

1. Total from Column G X Annual Insurance Rate = Annual insurance cost for all equipment listed.

2. $\frac{\text{Program total from Column O}}{\text{Over-all total from Column O}} \times 100 =$ % annual joint equipment cost for each program (Column U)

3. % annual joint equipment cost for program (Column U) X Annual insurance cost for all equipment listed = Annual program insurance cost for joint equipment (Column V)

Column W provides for the recording of interest on the capital investment cost for joint equipment by program. This cost is computed by dividing the total for Column G by 2 to obtain an average figure. That result is multiplied by the current rate of interest paid on school bonds to yield the amount of interest on the capital investment for all the equipment on the form. The percent for the program recorded in Column U is then multiplied by the amount of interest on the capital investment for all of the equipment on the form to yield interest attributable to each program which is entered in Column W. This procedure is illustrated in the formulas below:

1. $\frac{\text{Total from Column G}}{2}$ X Current interest rate paid on school bonds = Interest on the capital investment for equipment listed

2. $\frac{\text{Program total from Column O}}{\text{Over-all total for Column O}} \times 100 =$ % annual joint equipment cost for each program (Column U)

(Step two has already been completed if insurance costs have been calculated.)

3. % annual joint equipment cost for program (Column U) X Interest on capital investment for equipment listed = Program interest on the capital investment for joint equipment (Column W)

Columns U, V, and W are recorded on a program basis only, not on an item by item basis.

As with Form I, only parts of Form II may be used. To determine annual acquisition costs only, Column A through O are needed. Columns U, V, and W may be used with out adding Columns P through T. Column U is necessary for calculation of figures for both Columns V and W. Column W allows calculation of opportunity costs for equipment used jointly by programs. Columns P through S are needed to determine electrical power usage cost. If maintenance and repair costs are desired, Column T is added.

Either a card or list format would be appropriate for Form II.

The yearly update form for jointly used equipment is presented in Figure 4. The adjustments required each year are the same as those discussed for the yearly update of Form I with a few exceptions. Because Form II deals with the program level rather than the course level, Columns L, M, N, and O would require adjustments when changes have occurred in program usage of equipment. Changes at the course level would be reflected at the program level. The same would be true for Columns Q through W. Rate changes for electricity would be reflected in Column R. Changes in insurance rates would be reflected in Column V. Changes in interest rates on the capital investment would be reflected in Column W. Interest on the capital investment and insurance costs for new jointly used equipment additions should be entered on Form II where the other information on new joint equipment items should be entered rather than on the yearly update form.

The yearly update forms provided for Forms I and II and for Form III presented in the next chapter illustrate the columns requiring yearly attention. All the update forms apply only to equipment already listed on the original form. New equipment must be added to the original form and then would have updated information added the following year.

Fig. 4--FORM II Yearly Update

School District_____

JOINTLY USED EQUIPMENT INVENTORY, DEPRECIATION AND COST ANALYSIS FORM

Secondary Vocational Programs

Year_____

K	L	M	N	O	Q	R	S	T	U	V	W
Cur. Value	Prog. Used in	No. Hrs. Used/Yr.	Prog. % of Tot. Prs.	Prog. Cost for Dep.	No. KW Hrs. Used/Yr.	Rate /KW Hr.	Elec. Cost /Yr.	Maint., Repair Cost/Yr.	% Tot. An. Cost	Prog. Cost Ins.	Prog. Cost Int.
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$
									Prog. Code___ % $	$	$

Chapter IV

FORM III: RENTAL EQUIPMENT COST ANALYSIS FORM

Form III, which is presented in Figure 5, provides for the recording of information concerning rented equipment. Although the yearly cost of rented equipment can be extracted from current operating cost accounts because it is paid for on a periodic basis, Form III provides for the collection of these costs by program. Other advantages of having a separate form for rented equipment for each program are: an inventory of rented equipment is provided by responsibility area showing under whose jurisdiction the equipment is used; and operating cost, and maintenance and repair cost information relative to the rented equipment is provided by program category.

Cost records for rented equipment are kept separate from purchased and donated equipment records for several reasons: 1) the school is generally not concerned with budgeting a lump sum for the cost of replacing the item by purchase; 2) servicing of rented equipment is frequently handled differently than is servicing of purchased equipment; 3) insurance on rented equipment is carried by the rental company, not the school; 4) several information items required for purchased equipment records are different from those needed on rented equipment.

It would be expected that, in most programs, there would be fewer rented equipment items than purchased items. Form III contains the same basic kinds of information as does Form I with the exception of depreciation-related items and current value.

The information at the top of the form and that required in Columns A-D is obtained in the same way as for these columns on Form I. Column E represents the date the equipment item was rented or was put into use depending on what dates the rental covers. For example, if the agreement to rent an equipment item was made August 1 but the equipment is not delivered and used until September 1 and the rent is paid starting September 1, then the appropriate date to enter in Column E is September 1.

Column F indicates the rental basis (monthly, yearly, etc.). Column G indicates the rate of payment ($20/mo., $150/yr., etc.). If the rental period in Column F is yearly, then the figure in Column G can be entered in Column H. If the figure in Column F is monthly, then the number of months the equipment is rented during a year must be multiplied by the figure in Column G to yield the appropriate yearly cost for Column H. If an item is rented on a weekly basis, then the weekly cost times the number of weeks the item is rented during a year (a "year" being either fiscal year or academic year, whichever is consistent with other cost data) will yield the appropriate figure for Column H. It should be remembered that whatever time period is defined as a "year" must be the same time period used in completing all the forms to yield annual program costs. In other words, fiscal year cannot be used on one form and academic year on another.

Columns L through T are completed in the same manner as these Columns on Form I. Equipment rented for joint use by programs can be recorded on a separate form or added to the joint equipment form since it is likely that the number of items would be small. If added to Form II, yearly rental cost would be entered in Column J with no entries made in Columns F, G, H, I, and K.

Inclusion of Column T may or may not be appropriate depending on the service policy of the rental firm. For many equipment items, however, the

school will bear some maintenance and repair expense. For instance, the school would furnish the ribbons for rented electric typewriters.

If course costs are not obtained for other equipment, Columns L, N, and O would be deleted from Form II as well as sub-entry lines in Columns M, Q, S, and T.

Occasionally rent paid on an equipment item is applied toward the purchase price of the item if the school decides to buy the item. In this case, when the item is purchased and the remainder of the purchase price is paid in a lump sum, the equipment item should be removed from the rental Form III and added to the purchased equipment Form I. The lump sum paid for the remainder of the purchase price should then be depreciated over the expected remaining life of the item. The item may or may not be assigned a new inventory number depending on the inventory numbering system used by the school.

As with Form I and II, Form III can be put in a card or list format.

The yearly update form for rental equipment is presented in Figure 6. The update form would apply only to equipment rented the past year and rented again in the present year. Equipment rented for the first time should be recorded on Form III, not on the yearly update form.

Columns F, G, and H will require adjustment only if the period of time for which the equipment is rented is changed from the previous year or if the rental company has changed its rates. Columns L through O and Q through T would require adjustment in the same kinds of instances as described for the yearly update of Form I.

Fig. 6--FORM III Yearly Update

School District_____

RENTAL EQUIPMENT COST ANALYSIS FORM

Secondary Vocational Programs

Year _____

Program Code_____

Program Name_____

F Rental Period	G Cost/ Rental Period	H Yearly Rental Cost	L Courses Used in	M No. Hrs. Used/Yr.	N Prop. of Tot. Hrs.	O Course Cost for Rental	Q No. KW Hrs. Used/Yr.	R Rate /KW Hr.	S Elec. Cost /Yr.	T Maint. & Repair Cost/Yr.

Chapter V

FORM IV: YEARLY SUMMARY

Form IV presented in Figure 7 is the yearly summary which facilitates the summarization of data, establishment of program totals, and comparisons between programs.

Column (1) indicates the program code from the top of Forms I and III and from Column L of Form II. Column (2) provides the name of the program.

Columns (3), (4), (5), and (6) represent the end of the column totals for Columns J (yearly depreciation), and S (electrical operating cost), and T (maintenance and repair) and the total insurance cost from Form I for purchased and donated equipment.

Column (7) represents the sum of all the entries related to the same program code in Column J on Form II. Column (8) represents the sum of all the entries related to the same program code in Column S on Form II. Column (9) represents the sum of all the entries related to the same program code in Column T on Form II. Column (10) represents the total insurance cost for each program from Column V on Form II.

Columns (11), (12), and (13) represent the end of column totals for Columns H (yearly rental cost), S (electrical operating cost) and T (maintenance and repair) from Form III for rented equipment.

Column (14) represents the total acquisition cost of the equipment for a program category. This figure helps answer questions such as, "What amount of dollars will have to be budgeted for equipment acquisition if we plan to

start an agriculture program in our school having specified sub-programs?" or "How much does it cost to start an agriculture program having x, y, and z sub-programs?"

Column (15) indicates the amount of electricity consumed in operating program equipment. This information is helpful in answering such questions as "What affect will the addition of this program have on our overhead costs?"

Column (16) indicates the maintenance and repair costs required by the equipment in a program. This information is helpful in determining the kind of use and care the equipment receives, and in deciding whether or not to replace equipment items.

Column (17) represents the equipment-related annual dollars expended for a program category. This total figure includes the year's share of the equipment acquisition costs, the electrical power usage for instructional equipment for the year, the year's equipment maintenance and repair costs, and the year's insurance costs for equipment.

Column (18) indicates the annual interest on the capital investment from Form I which is the interest on the capital investment for equipment purchased for use in a single program. Column (19) indicates the interest on the capital investment for each program from Column W of Form II. Because it is necessary to locate the program code numbers on Form II in Column L, grouping equipment items by the program in which they are used would facilitate this process. Such grouping would not always be possible but the effort to group items by programs when possible would be worthwhile.

Column (20) represents the total annual opportunity cost for owning equipment used in a program including equipment purchased for use in one program only and that purchased for use in more than one program. This information is helpful in cost-benefit studies.

Column (21) represents the annual total cost of equipment for each program including dollars expended for acquisition, power usage, maintenance and repair, insurance, and the opportunity cost of the investment. This figure is also useful for cost-benefit analysis.

Form IV is an annual form. Column (1) and (2) can be permanently duplicated for convenience. The form provides summary cost data for equipment by program, and by type of cost (object). From this form it is possible to determine the annual cost of owning the equipment [yearly depreciation plus interest on the capital investment - Column (14) plus Column (20)] in a program, and the annual operating costs for the equipment in a program [power costs plus maintenance and repair - Column (15), plus Column (16)]. Thus, direct and indirect cost categories are kept separate but can be added when appropriate. Initial investment costs are separated from on-going costs allowing estimates of what programs will cost to implement and what they will cost to maintain relative to equipment. Thus, recurring and non-recurring costs are kept separate but can be added together. Such cost information contributes toward the determination of marginal costs, total annual program cost, annual program per student cost, and program cost analysis and cost-benefit analysis. A total equipment cost figure is helpful information when considering the adoption of new programs, the elimination of present program, and when planning budgets and resource allocations. It should be emphasized again that this kind of cost information is not adequate in itself as decision-making information but must be coupled with information concerning program objectives attainment, alternative programs, manpower projections, student interest, etc. The availability of cost information on a program basis eliminates one area of speculation for decision-makers. More confident and decisive action is possible when facts are available.

If Forms I, II and III include only those columns pertaining to determination of annual acquisition costs, Form IV would include only Columns (1), (2), (3), (7), (11), (14), (18), (19), (20) and a Column (21) calling for the addition of Columns (14) and (20).

This sytem employs a micro-level approach to the on-going recording of educational equipment costs by educational program. The primary functions of the system include depreciation of educational equipment, determination of annual costs by educational program, by equipment item, and by course section for equipment acquisition, power consumption, maintenance, and repair, interest on the capital investment, and insurance. The system provides for cost analysis procedures which allow cost comparisons and the determination of relationships and trends.

The procedures recommended and forms presented here will likely raise as many questions as they have attempted to answer. It is recognized that they are incomplete and do not provide for all situations. For this reason, it is recommended that a continual effort be made to refine, revise, and gradually develop instruments which can adequately provide for most or all educational situations and which can yield appropriate data more efficiently.